EMC BASIC TRAINING_TASA_2025

ROHDE&SCHWARZ

Make ideas real

AGENDA

- EMC 電磁波基本概念介紹
  - EMI 電磁波基本概念介紹
  - EMS 電磁波基本概念介紹
  - EME 複雜性電磁波基本概念介紹

- EMI 電磁波干擾訊號量測介紹
  - 頻譜分析儀與EMI Test Receiver 的差異性
  - 如何依據規範正確的量測EMI Emission 訊號
  - 如何快速(Time Domain Scan)與正確的量測EMI Emission 訊號

- Q&A

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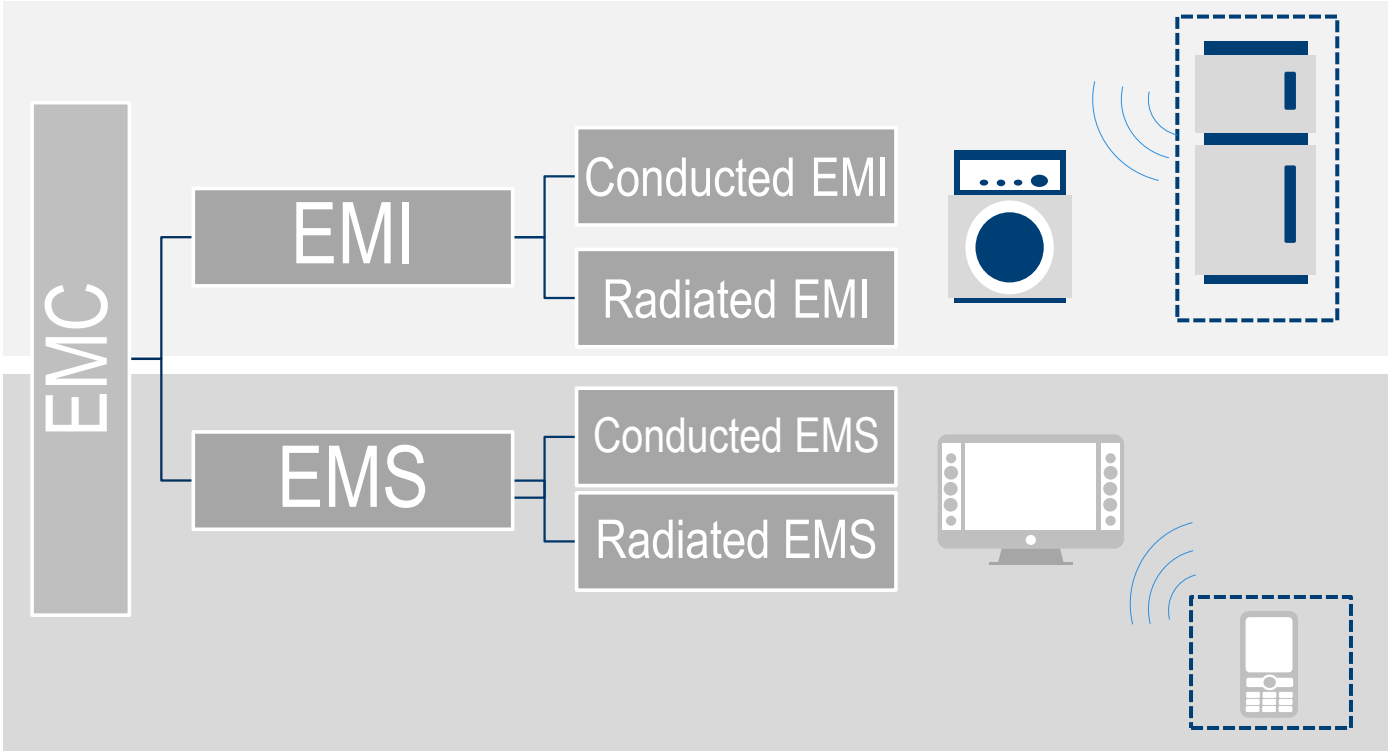
EMC FUNDAMENTAL INTRODUCTION-EMI BASIC CONCEPT
WHAT IS EMC?



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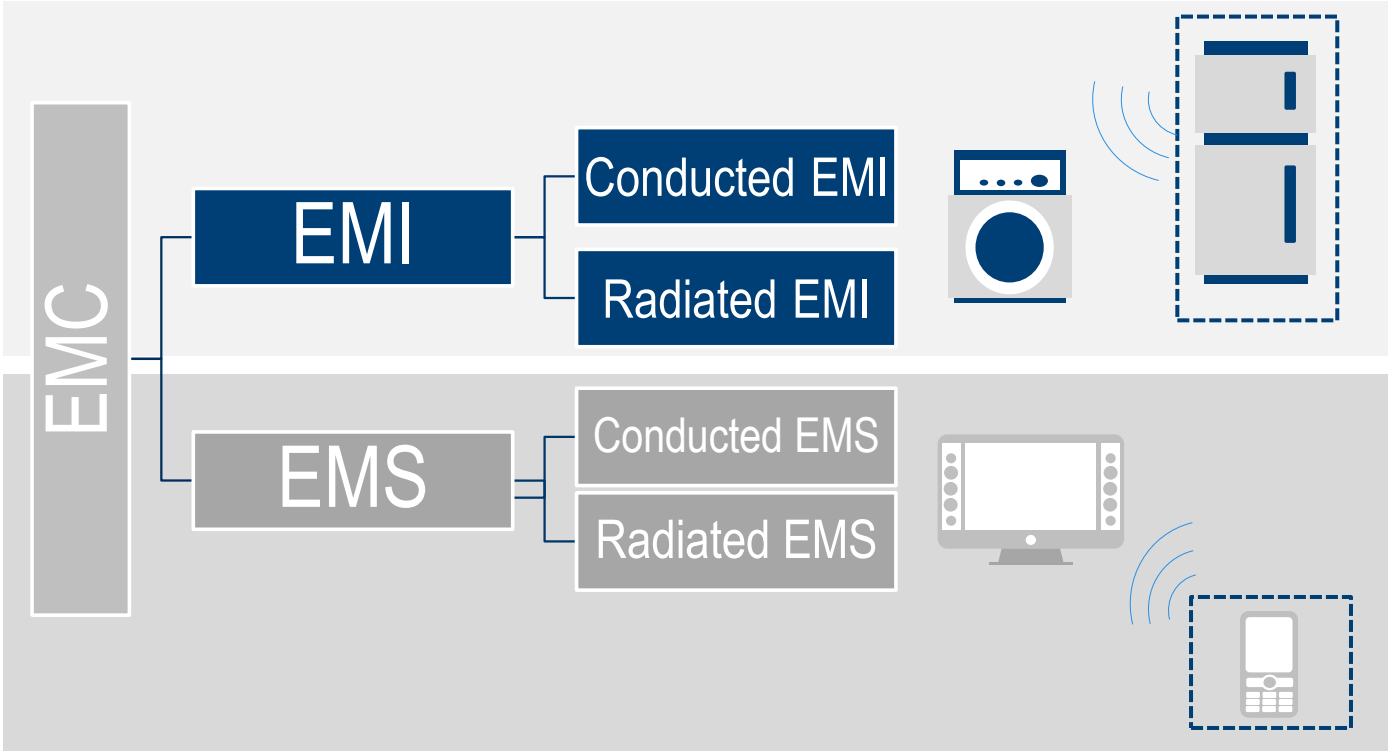
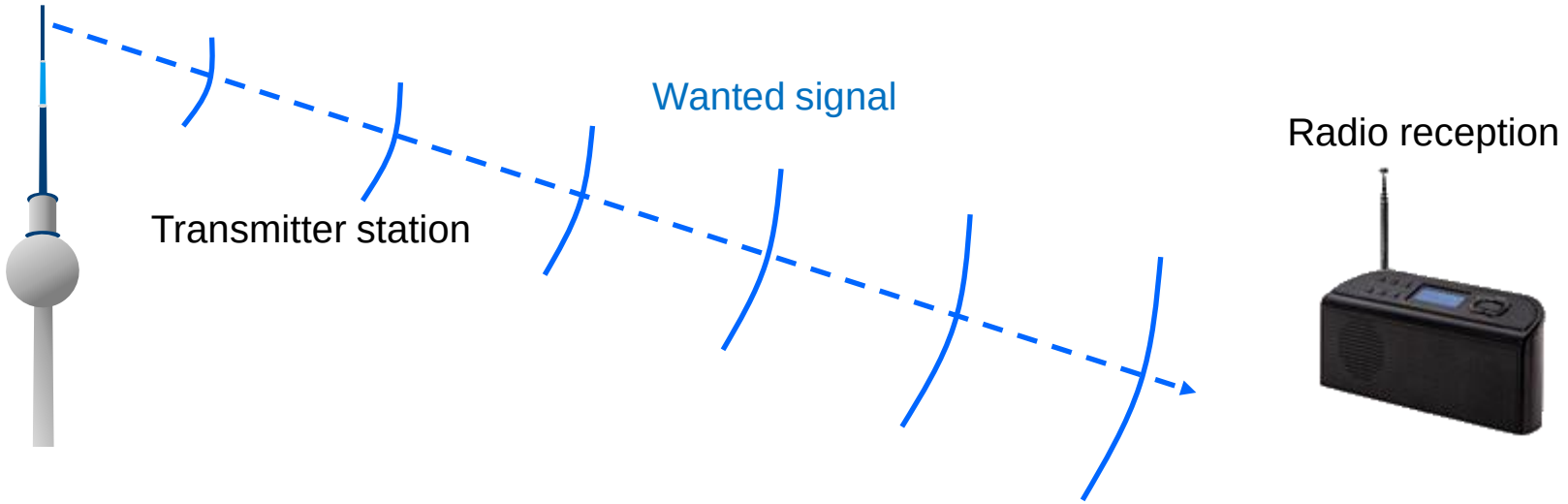


INFLUENCE OF RF EMISSIONS

Example: interference of radio reception



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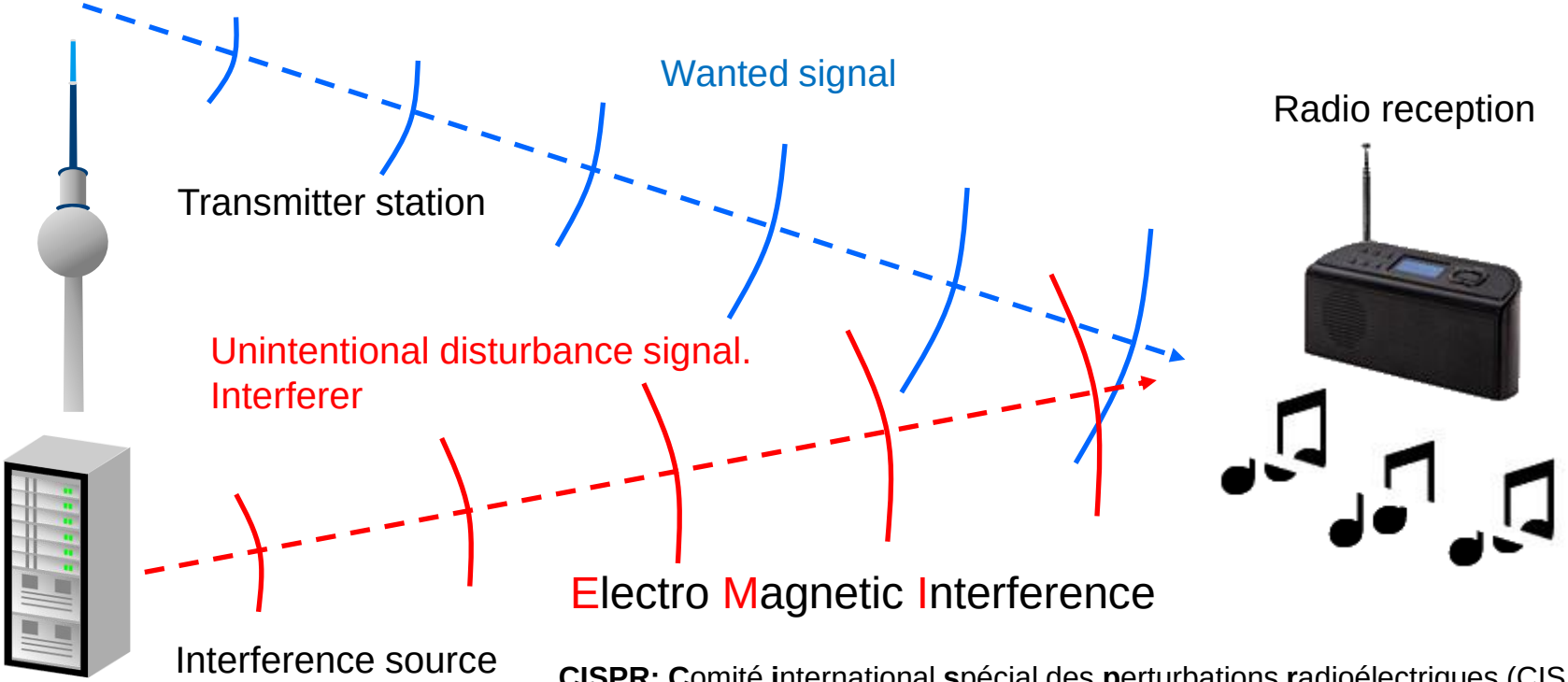

CISPR: Comité **i**nternational **s**pécial des **p**erturbations **r**adioélectriques (CISPR)
International Special Committee on Radio Interference (CISPR)

INFLUENCE OF RF EMISSIONS

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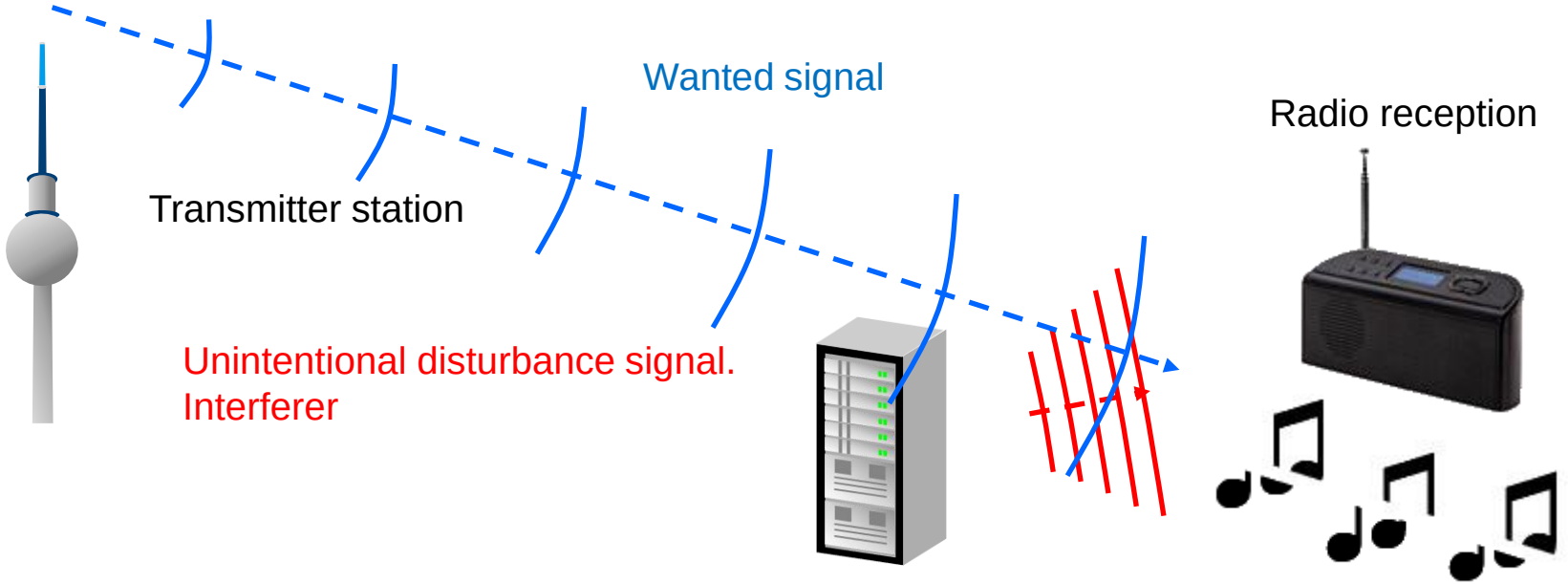

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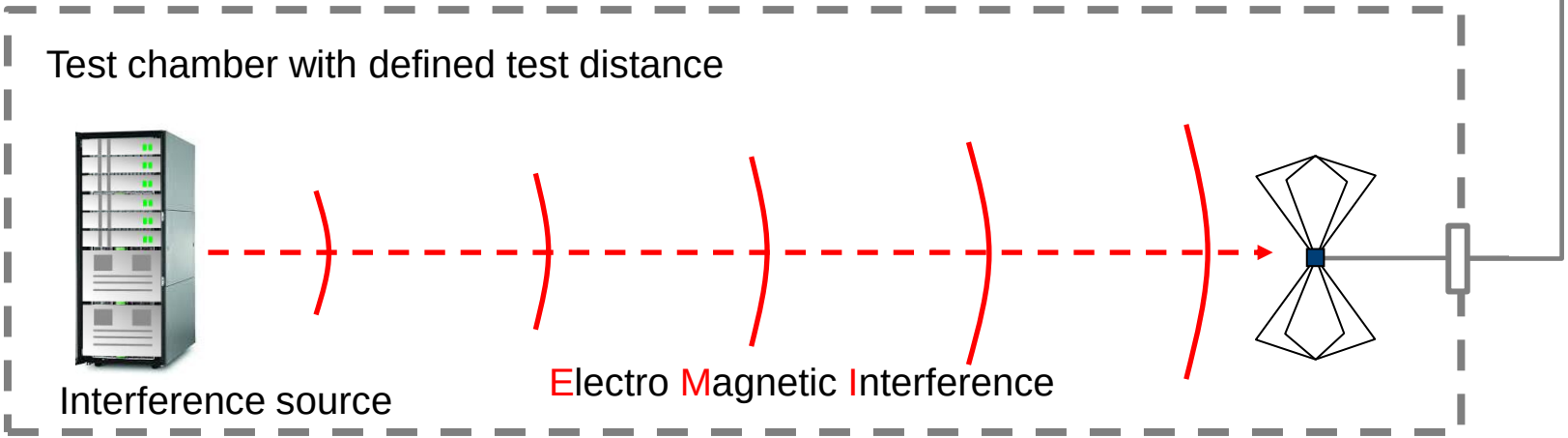
ISOLATION

Target: defined and reproducible test

- The Equipment Under Test (EUT) is located in the shielded test chamber.



EVALUATION

Target: defined and reproducible test

- The receiver evaluates the received field strength and compares the result with a defined limit.

Test chamber with defined test distance

Interference source

Electro Magnetic Interference

EMC DIRECTIVE : ESSENTIAL REQUIREMENTS

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02014L0030-20180911

Equipment shall be so designed and manufactured, having regard to the state of the art, as to ensure that:

a) the electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended;

EMI – Emission

ELECTROMAGNETIC COMPATIBILITY | EMC

without introducing intolerable electromagnetic disturbances
to anything in that environment”

[IEC International Electrotechnical Commission, 161-01-07]

EMI – Emission

ELECTROMAGNETIC DISTURBANCE

“electromagnetic phenomenon that can degrade the performance of a device, equipment or system, or adversely affect living or inert matter”

[IEC International Electrotechnical Commission, 161-01-05]

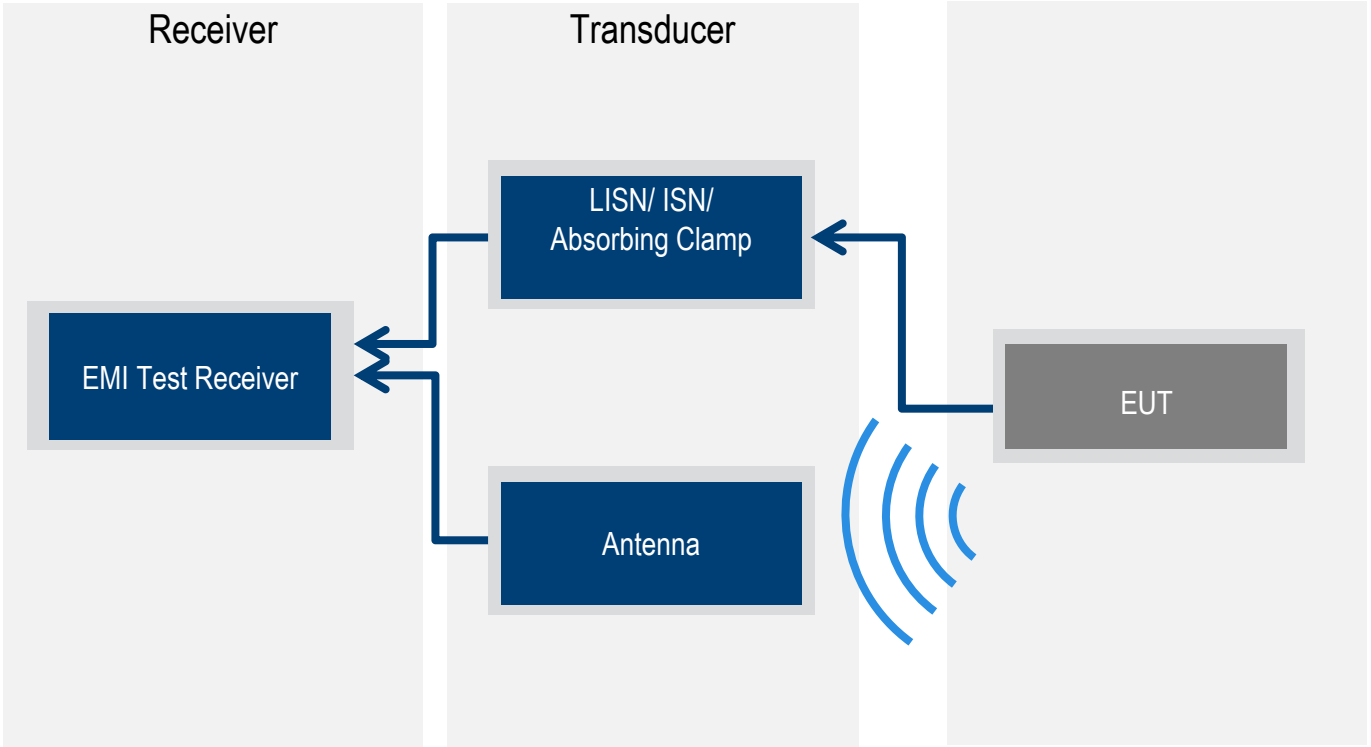
ELECTROMAGNETIC INTERFERENCE | EMI

“degradation in the performance of equipment
or transmission channel or a system
caused by an electromagnetic disturbance”

[IEC International Electrotechnical Commission, 161-01-06]

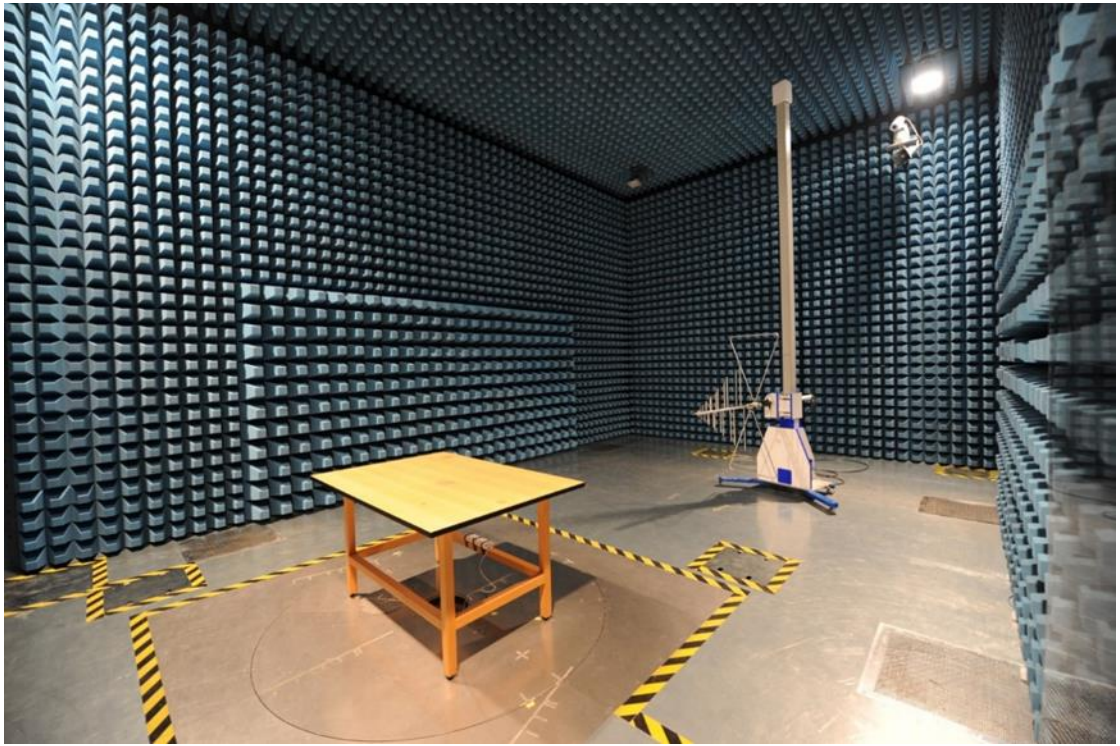
Note: The term “EMI” is commonly used for EMIssion as well.

EMC FUNDAMENTAL INTRODUCTION-EMI BASIC CONCEPT
SYSTEM CONFIGURATION:

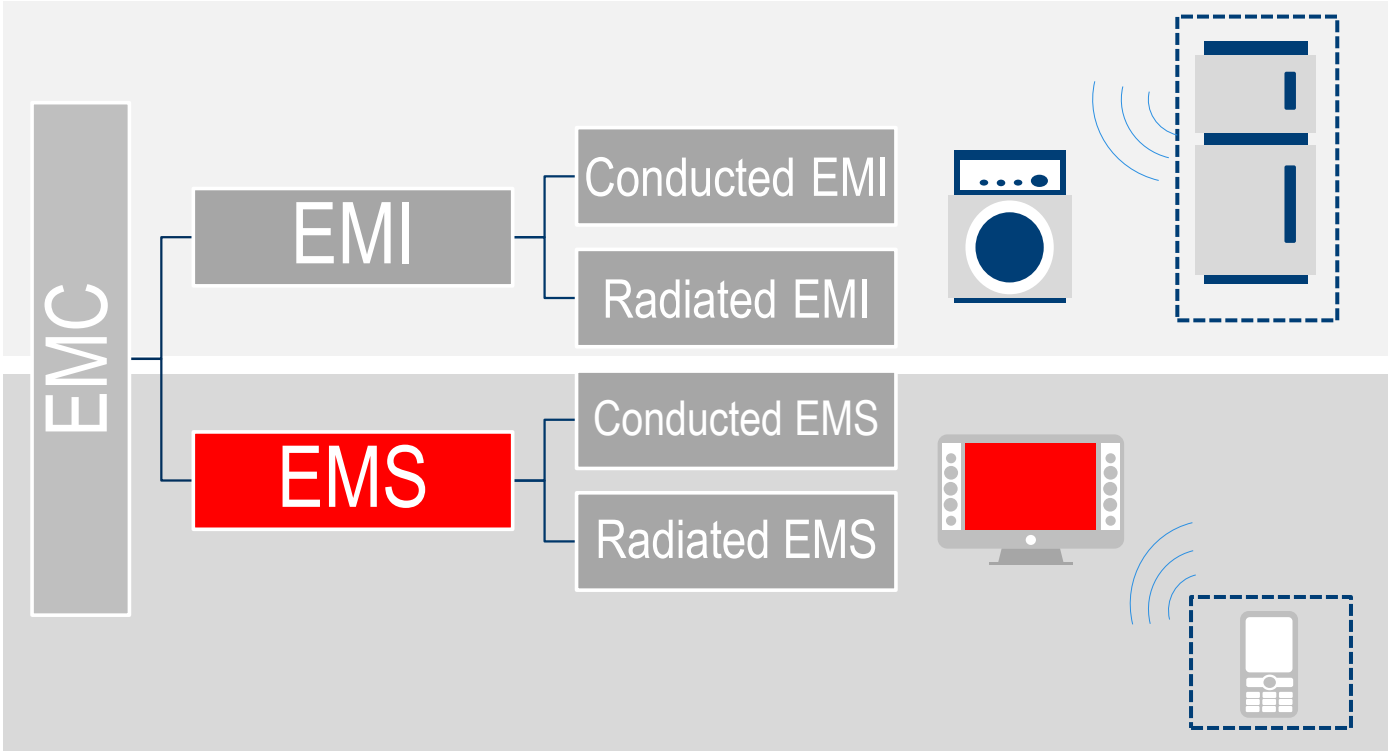


EMC FUNDAMENTAL INTRODUCTION-EMI BASIC CONCEPT
EMI TEST SITE_CONDUCTED MEASUREMENT :

EMC FUNDAMENTAL INTRODUCTION-EMI BASIC CONCEPT
EMI TEST SITE_RADIATION MEASUREMENT :



EMC FUNDAMENTAL INTRODUCTION-EMS BASIC CONCEPT
WHAT IS EMS?



EMC DIRECTIVE : ESSENTIAL REQUIREMENTS

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Equipment shall be so designed and manufactured, having regard to the state of the art, as to ensure that:

a) the electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended;

EMI – Emission

b) it has a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without unacceptable degradation of its intended use

EMS – Immunity

ELECTROMAGNETIC COMPATIBILITY | EMC

“ability of equipment or a system to function satisfactorily in its electromagnetic environment

EMS – Immunity

without introducing intolerable electromagnetic disturbances to anything in that environment”

[IEC International Electrotechnical Commission, 161-01-07]

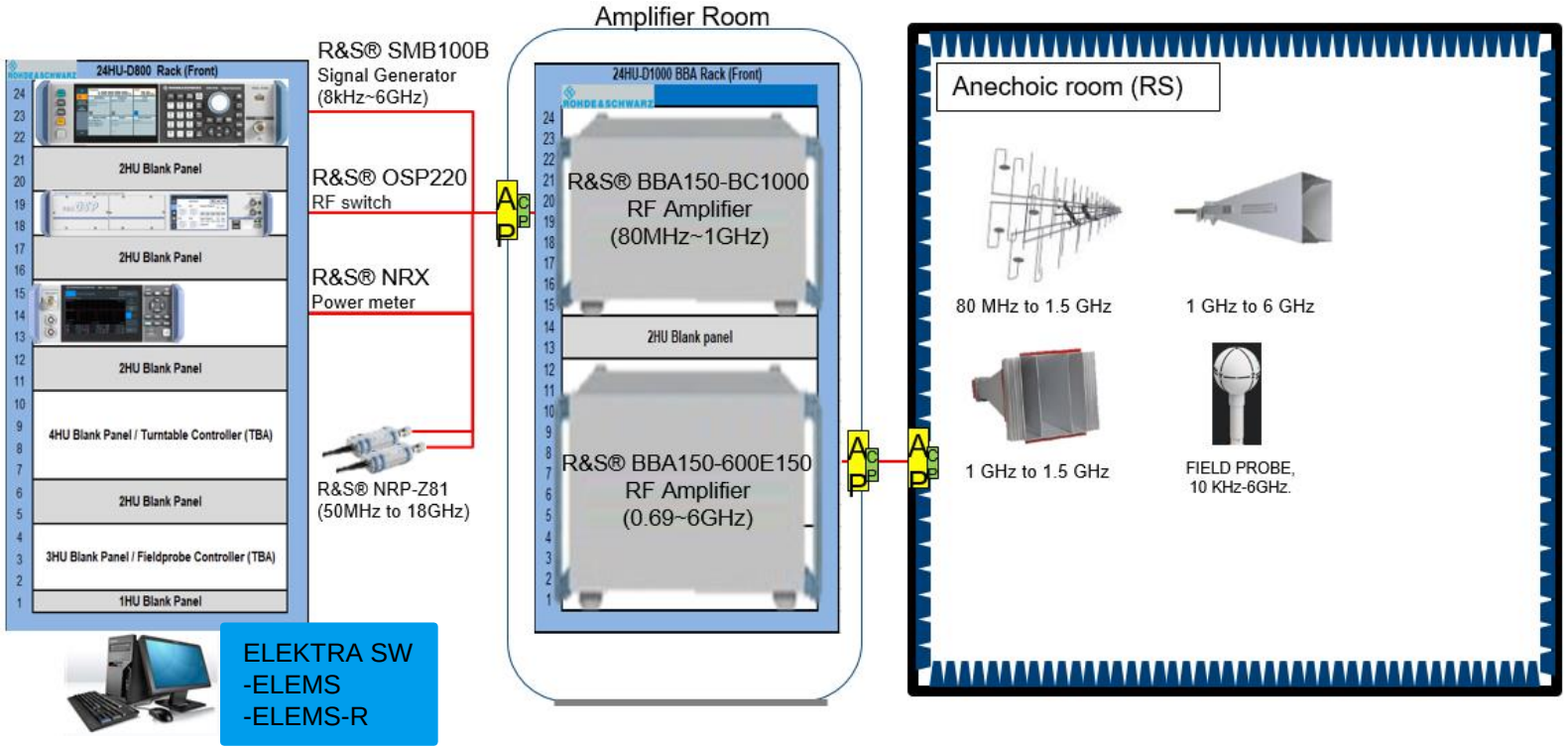
EMI – Emission

IMMUNITY (TO A DISTURBANCE)

“the ability of a device, equipment or system
to perform without degradation
in the presence of an electromagnetic disturbance”

[IEC International Electrotechnical Commission, 161-01-20]

EMS TEST SYSTEM TS9982



ELECTRO-MAGNETIC ENVIRONMENT (EME) TESTING

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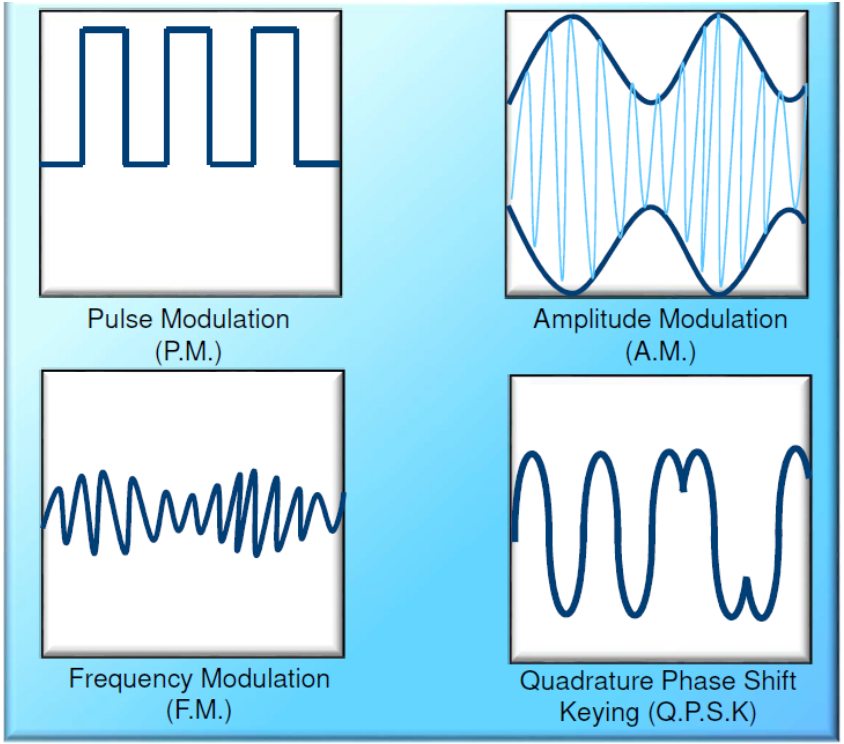
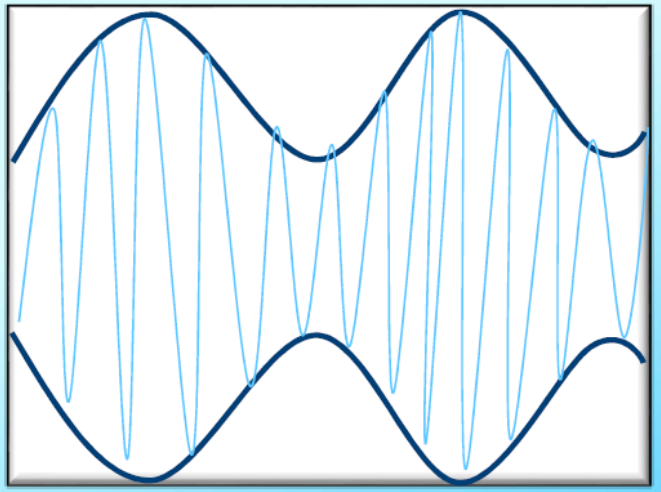
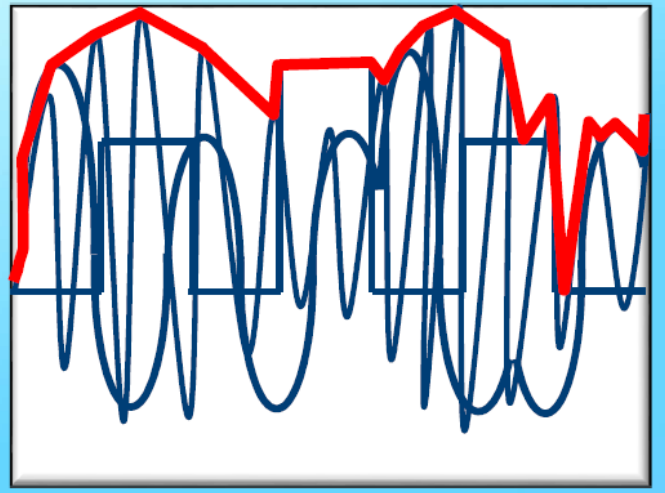
FIXED MODULATION FOR CONVENTIONAL EMS



CONVENTIONAL EMS SIGNAL VS EME SIGNAL

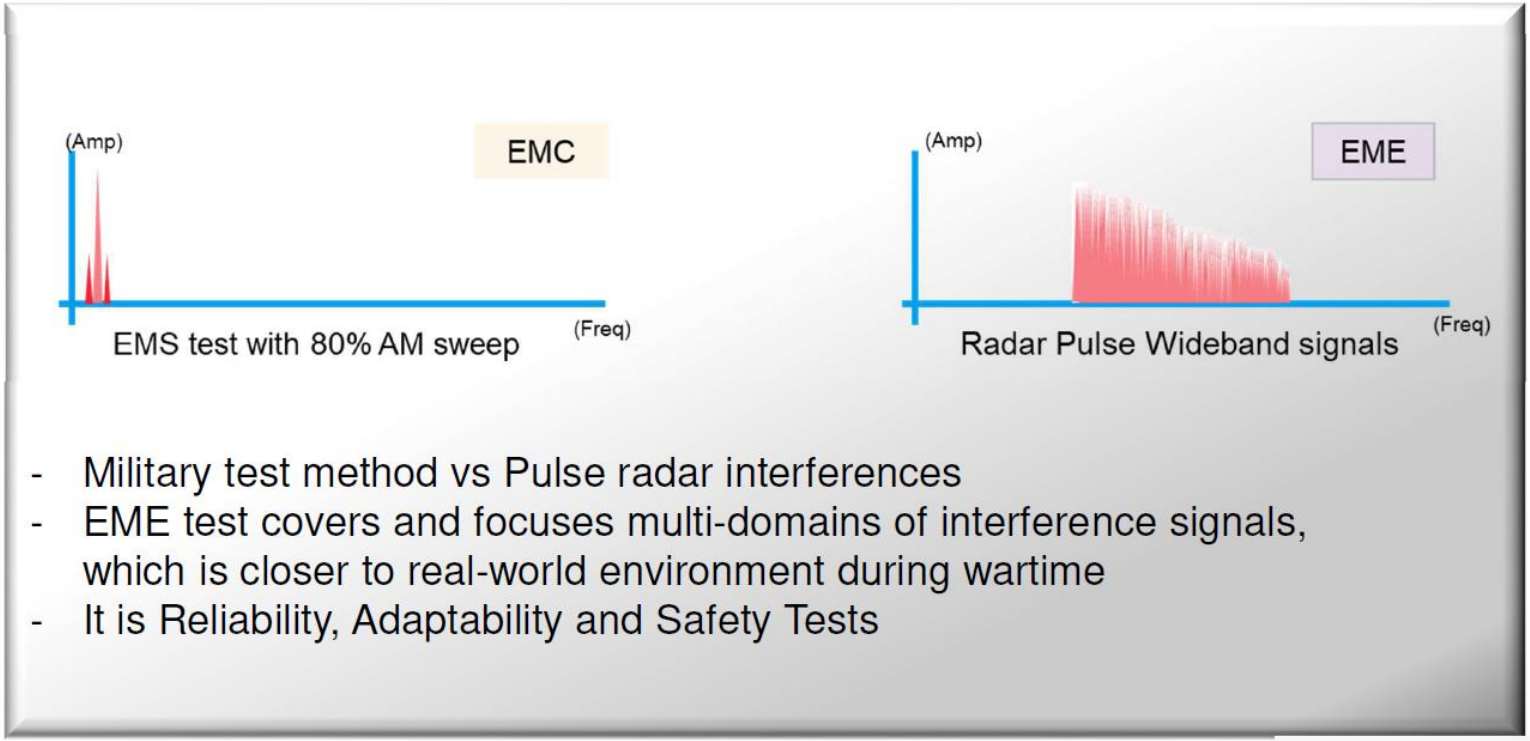


Amplitude Modulation
(A.M.)



Example of EME Signal

CONVENTIONAL EMS SIGNAL VS EME SIGNAL



- Military test method vs Pulse radar interferences
- EME test covers and focuses multi-domains of interference signals, which is closer to real-world environment during wartime
- It is Reliability, Adaptability and Safety Tests

ELECTRO-MAGNETIC ENVIRONMENT (EME) TESTING

► **EME Effects test** is putting the DUT/SUT under the sum of

- EMC tests which directly tests for safety and reliability of electrical & electronic devices;

- **Radio coexistence** which evaluates performance and functionality in the presence of known radio and wireless communication signals;

- **Scenarios** that introduce diverse operational environments; in order to know the **Worst-case Effects** and evaluate the **Safety Integrity** of the DUT/SUT by advance analysis methods

THANK YOU FOR YOUR ATTENTION